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United States Department of Agriculture,

DIVISION OF ENTOMOLOGY.

THE MEXICAN COTTON-BOLL WEEVIL.

(*Anthonomus grandis* Boh.)

GENERAL APPEARANCE AND METHOD OF WORK.

This insect is a small, grayish weevil, of the shape and general appearance shown in Fig. 1 *a*, and measuring a little less than a quarter of an inch in length, which is found in cotton fields throughout the season, puncturing and laying its eggs in the squares and bolls. The larvæ, of the shape and appearance shown at Fig. 1 *c*, and measuring a little over three-eighths of an inch in length when full grown, live within the buds and bolls and feed upon their interior substance. The squares attacked usually drop, but most of the damaged bolls remain upon the plant and become stunted or dwarfed, except late in the season, when they either dry or rot.

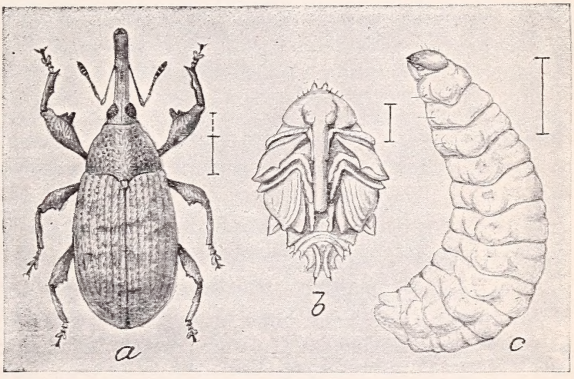

FIG. 1.—*Anthonomus grandis*: *a*, adult beetle; *b*, pupa; *c*, larva—all enlarged.

DISTRIBUTION.

The species is originally Mexican, and for many years has been found in the region around Monclova, in the State of Coahuila. From 1856 to 1862 it was so bad in that region that cotton planting was abandoned. It appeared in the vicinity of Matamoros some years ago, crossed the river to Brownsville, and within the last two or three years has spread north into the country around San Diego, Alice, and Beeville, Tex., and threatens to spread throughout the cotton-growing regions of Texas, if not to other States. The accompanying map shows the distribution of the insect at the close of the sea-

son of 1894, the cross-barred portions indicating the regions more or less severely damaged, and the single-lined portion the region in which it will probably be injurious the coming season.

IT MUST NOT BE CONFUSED WITH THE SHARPSHOOTER.

In Mexico the insect is known to cotton growers as the "*picudo*," and in the Brownsville region cotton planters have named it the "sharpshooter." From the fact that this term has been used by the Brownsville cotton planters, some confusion has arisen among planters living farther north, and many of them have supposed that the insect is nothing but a species which has been known for many years in

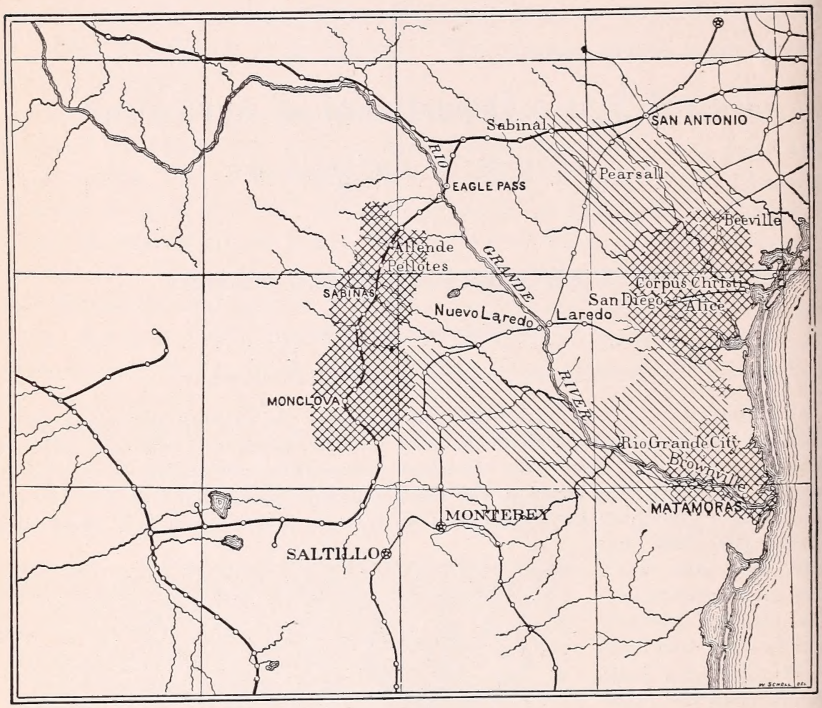

FIG. 2.—Map showing the present known distribution of the cotton-boll weevil in Texas and Mexico.

Texas, and to which this same popular name of "sharpshooter" has been applied. In general, it may be said that whenever bolls or squares have been pierced by any insect, and wilt in consequence, the work is called "sharpshooter work," not only in Texas, but in Louisiana, Mississippi, and other portions of the cotton belt. While several insects are engaged in this so-called sharpshooter work, the most abundant one is that shown at fig. 3. This is the so-called "glassy-winged sharpshooter" (*Homalodisca coagulata*), belonging to an entirely different group of insects from the Mexican cotton-boll weevil.

The glassy-winged sharpshooter has been present in Texas cotton fields ever since the cultivation of cotton began, since it was originally not a cotton insect, but fed upon the poplar tree. The Mexican cotton-boll weevil is not only quite a different insect, but it is a far more dangerous one. It is much more abundant and its attacks upon bolls and squares are much more serious, since not only are the bolls punctured with the beak, as is the case with the glassy-winged sharpshooter, but eggs are inserted and larvæ hatch, which feed upon the interior substance.

NATURAL HISTORY AND HABITS.

The natural history of the Mexican cotton-boll weevil is as yet imperfectly known but so far as can now be judged, it is as follows:

When the insects first appear the eggs are deposited in the squares and bolls, and the larvæ hatch and feed on the interior substance of the buds and bolls. The larvæ sometimes feed on the interior of the seed, leaving only the shell, but usually eat seed or fiber indifferently. The larva gradually reaches full growth, having by this time formed a cell of sufficient size to accommodate itself, and in this it pupates. The cell is usually formed next the outer wall or pericarp of the boll, so that the weevil, when transformed, has only to make its way through this wall to escape. In issuing, it thus leaves a small hole in the pericarp, which marks the cell in the infested lock of the boll. As many as eleven larvæ have been found in one boll.

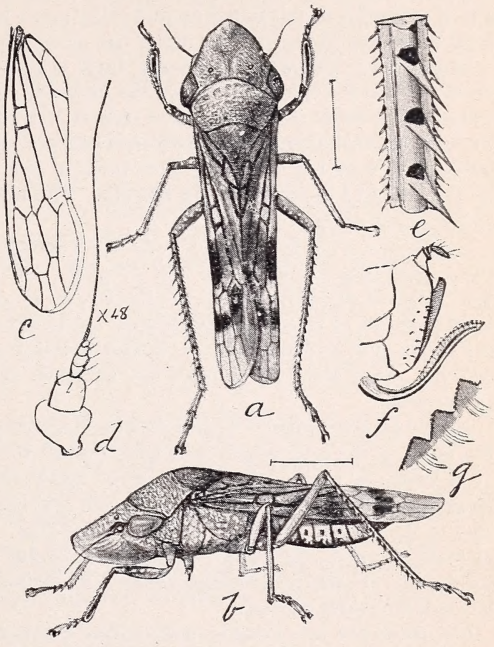

FIG. 3.—Glassy-winged sharpshooter: *a*, adult ♀ seen from above; *b*, same, side view; *c*, venation of forewing—enlarged; *d*, antennæ; *e*, section of hind tibia; *f*, ♀ genitalia—more enlarged; *g*, serrations of ovipositor—still more enlarged.

Judging from the habits of the allied species, *Anthonomus signatus*, and allowing for differences in size and climatic conditions, the duration of the life-cycle is probably about thirty days.

In the newly infested region in Texas, the weevils were first noticed in the cotton fields from about the middle of August to the last of September; in the newly infested region of Coahuila, a month earlier; in the older infested regions of Texas (Brownsville) and Coahuila (Hermanas), as early as May to June. Approximate dates of their first appearance in newly infested regions have been received as follows: Corpus Christi (Nueces region), middle of August; Beeville, last of August and first of September; San Diego, first of September.

Nothing is known positively concerning the number of annual broods, but there were probably two broods in the newly infested region, and in the older districts, where the weevils appear in May and June, there must be four or more broods annually.

At San Juan Allende, Coahuila, two very small larvæ were found in buds, November 23, and at Alice, Tex., another was found in a green bud, December 12. This seems to indicate a very late brood if, indeed, the broods are at all regular. Egg laying probably goes on at all times, so that the broods are more or less irregular.

Food plants and habits of feeding of the adult.—The only food plant so far as known is cotton. The adults seem to feed both on the buds and bolls, and throughout the season as long as the weather is warm. By means of the small jaws at the end of its beak, the weevil eats through the skin of the bud or boll, making a small hole therein. Specimens were found as late as December 10, 36 miles north of Brownsville, with their beaks sunk to full length in half-grown green bolls, apparently feeding on the juices within.

Extended inquiry show that the weevils always remain within the squares or on the bolls, and never feed on the leaves, nor are they ever seen on the latter.

The weevils were found at San Tomas, and just north of Brownsville, infesting fields of sea-island cotton as badly as the upland variety. There seems no hope, therefore, of finding a variety of cotton that will not be attacked by it.

If the weevil has another food plant, it will probably be found in the Monclova region of Coahuila. No wild malvaceous plant could be found in the regions visited, and the insect was not found on any other plant than cotton. Information obtained from Monclova states that the insect has never been known there on any other plant.

Oviposition.—The weevils deposit their eggs first in the buds, which are to be found within the squares. When the buds are all infested, the females oviposit in the smallest bolls, then in the next largest, until all are attacked that are still green. Judging from the egg-laying habits of the genus, the female makes the hole in the bud or boll with her beak, and then turning around, applies the tip of the abdomen to the hole and deposits an egg therein. The same female may deposit a considerable number of eggs.

Appearance of an infested field.—As the weevils attack first of all the buds within the squares, these usually die and drop off. Therefore, as soon as a field becomes well infested, the presence of the insect can be told at once by the fact that few or no blooms are to be seen on the plants. A field may be in full bloom, but as soon as the insect gets well spread over it and accomplishes its work hardly a bloom will be seen. Soon after the squares are attacked they mostly turn yellow and fall to the ground.

Method of hibernation.—A considerable percentage of the weevils winter over in the bolls, in the cells which they have formed therein, either as transformed weevils or as pupæ, or perhaps even as larvæ. That they may sometimes winter as larvæ seems proven from the finding, as above mentioned, of very small larvæ from the last of November to the middle of December. They probably winter more frequently as pupæ, the latter having been found in the bolls up to the middle of December. Newly transformed adults were found plentifully in the bolls also during late fall and early winter.

But there are many other individuals belonging to earlier broods which have issued and certainly will not reenter the bolls to hibernate. The question is, Where do these hibernate? In San Juan Allende, where the fields are irrigated, there are many cracks in the earth, caused by the rapid drying of the soil after irrigating. On a cold day there it was found that some of the weevils had crawled into these cracks, and many weevils hibernate in such cracks and under clods of earth, under leaves, and other refuse.

Weevils were also found in Allende on the cold day above referred to (November 23) around the base of plants, under dry fallen leaves.

In fields where neither cracks, clods, nor fallen leaves exist, as happens often in southern Texas, where the plants remain green until late in winter, many weevils probably winter in the squares and under the leaves at the base of the bolls. At Alice and Benavides, Tex., the plants were perfectly green December 12, there having been no frost. In a field there, on that date, many weevils were found inside the squares, as many as four in one square ; also at the bases of the bolls. Many were neither feeding nor ovipositing, but were perfectly inactive. The squares afford excellent protection to the weevils in cold or in rainy weather. During rainy weather in San Juan Allende (November 28) weevils were found numerously huddled in the squares by threes and fours.

Live weevils were found at Brownsville inside old bolls in March, showing that the insect can successfully withstand quite severe cold. The Weather Bureau records show that twice during the past winter severe frosts were experienced all over the infested region. Up to April 1, although diligent search was made, no hibernating beetles were found under leaves or in cracks in the ground around Brownsville.

HOW THE INSECT SPREADS.

The natural spread of the insect by flight is slow, and it is questionable whether it would have traveled from its original home to the regions now infested by flight alone, since the cotton-growing regions are widely separated by districts in which no cotton is grown. It may have other food plants, although, as previously stated, none have yet been discovered. Should it be found that it is confined to cotton, it has probably been carried from one cotton-growing region to another in loads of unginned cotton when being taken to the gin. It is by such artificial portage that a large share of its future spread will be brought about, though when it has once entered a region of more or less continuous cotton fields, it will spread by flight from one field to another, season after season.

INVESTIGATION BY THE DEPARTMENT OF AGRICULTURE.

Twelve years ago a few specimens of this weevil were sent to the Department of Agriculture from Mexico, with the bare statement that it was known to feed upon cotton. No details were given, however, which indicated that an investigation was necessary. In the summer of 1894 it was sent to the Department by several cotton growers in Texas, and it was at once realized that unless checked the insect would become a very serious enemy to the cotton crop of the United States. An investigation was immediately begun. A special agent, Prof. C. H. Tyler Townsend, was appointed who traveled through the affected regions of both Texas and Mexico, and gathered the information upon which this circular is based, most of the matter upon the natural history and habits of the insect being given in his own words. He has been temporarily stationed at Brownsville, Tex., for the purpose of studying the life history of the insect the year through, in the hope that such an investigation will reveal some point in the habits of the species which will render the suggestion of some practical remedy possible. The attention of the Texas State authorities has been called to the importance of the insect, and to the apparent danger of allowing it to increase and spread. The legislature, during its present session, will consider the advisability of adopting quarantine and restrictive measures, and of enforcing remedial work.

REMEDIES.

It is early as yet to suggest remedies, since the Department has not had an opportunity to conduct any extensive experiments. So much yet remains to be found out about the life history of the insect that anything which can be said in this direction at present must be largely theoretical. Living, as the larva does, in the interior of the bud or boll, it can not be reached by ordinary insecticides, although an application of paris green or london purple, as for the cotton worm, made when the bolls begin to form, may kill a certain percentage of the adult weevils, since these feed, to some extent, on the outside of the bolls.

A great deal of good, however, can be done, and the insect can be largely reduced in numbers, by picking all affected bolls at the time of the cotton picking and burning them. If each cotton picker be provided with a separate bag in which to collect the infested bolls, it would not involve a great amount of extra labor to gather these as the cotton is picked. In regions where other crops can be grown, it will be well to practice rotation of crops, and not grow cotton two seasons in succession upon the same land.

Approved:

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WASHINGTON, D. C., *April 2, 1895.*

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